

From the house of Amar Chitra Katha and Tinkle

BRAINWAVE™

SCIENCE IS JUST A GAME

Vol. 03 Issue 07
July 2014
48 pages
For 8+ year olds
₹60

Stories, DIYs & Comics

10+ contests to win!

Be an Architect - Build the World! p08

p24
**Free
Poster!**

 /brainwavemag
Join 51k other fans!

p46 **Multiverse**

Ants vs. Bullies - the
architecture of
anthills!

Web-only Content
www.bwmag.in

p22 **Expert Talk**
Lady studying structures

Brainwave Science Magazine simplifies textbook science for 8-15year-olds. It makes lessons interesting by presenting them in the form of comics, stories, DIYs, fascinating facts, contests and much more. Grab your copy now! For subscription, turn to page 48.

AD

The Science We Build!

Dear young friends

Architecture isn't as simple as it seems to be. It involves planning, designing and constructing - while ensuring durability, utility and beauty. It's one of those rare disciplines that brings art and science together.

Building materials have evolved from ice, mud, clay, sand, stone, thatch, and timber to cement composites, concrete, glass, fibre, metal and plastic. Styles have progressed from vernacular, ancient, Asian, Islamic and medieval to renaissance and modern.

It isn't surprising that all wonders of the world are related to structures!

SK, sasikanth.c@ack-media.com

BRAINWAVE

Vol. 03 | Issue 07 | July 2014

Editor & General Manager
Sasikanth C

Consulting Art Director
Savio Mascarenhas

Assistant Editor
Priyanka Talreja

Design Lead
Ria Rajan

Design & Illustrations
Saudamini T & Pooja P

Resident Geek
Pushkar Samant

Founding Editor & Art Director
Vinayak Varma

Cover artwork by Parvati Pillai



No part of this magazine may be reproduced without the express consent of Amar Chitra Katha Private Limited (ACK). Any reproduction, modification, distribution, transmission, republication, display or exploitation in any way of the content(s), in whole or in part, of this magazine is strictly prohibited. ACK makes no warranties or guarantees, express or implied, written or oral, as to the contents of the magazine, the information, materials or opinions, included in this magazine. In no event shall ACK be liable for damages of any kind arising as a consequence of using or following any method or formula as mentioned in the magazine, including but not limited to direct, indirect, incidental, punitive and consequential damages.

Consumer Complaints:

+91-22-6629 6999
customerservice@ack-media.com

**Business Queries &
Customer Service Escalations:**
sasikanth.c@ack-media.com

Ad-sales:
advertisingsales@ack-media.com

Credits:
Neeti Saxena & team
Jayanthi V
Eric D'souza & team
Heta D & Shilpi M
India Book House & team
Janak F, Yogesh G & team
K.K. Arun & team
Lalit S & team
Mayur S & team
Narayan M, Sagar S & team
Sandeep S & team

Sr. VP Operations
Sandeep Padoshi

Digital Business Head
Shubhadeep Bhattacharya

Sr. VP Sales & Marketing
Prakash Batna

Advisory Board

Arvind Gupta
Scientist & Educator
AS Manekar, Dy. Director
National Council of Science Museums
Hari Parameswaran
Scientist & Educator
Dr. Chandrakant Shukre
Astrophysicist
Maya Menon, Director
The Teacher Foundation
Geetha Narayanan, Director
Srishti School of Art, Design & Technology
Dr. Balaji Sampath
Aid India Foundation
Siddharth Rao, Director
Agumbe Rainforest Research Station

Subscriptions:
brainwave@ack-media.com

**Brainwave is Printed and Published
by Vijay Sampath on behalf of Amar
Chitra Katha Private Limited Printed at
Indigo Press (India) Pvt. Ltd., Plot No.
1, C/716, Opp. Dadoji Konddeo Cross
Road, Byculla (E), Mumbai 400027
Published at Krishna House, 3rd
Floor, Raghuvanshi Mills Compound,
Senapati Bapat Marg, Lower Parel
(West), Mumbai 400013.**

BRAINWAVETM CONTENTS

A VISIT TO THE MUSEUM

COVER STORY

12


KNOW IT ALL

- p.11 Flash News
- p.18 Golden Gizmo★
- p.19 India Page
- p.32 Globe Trotter
- p.36 Planet Ninjas★

FUN FACTS

- p.22 Expert Talk★
- p.33 Celeb Science
- p.34 Animalia
- p.37 Storey Stories
- p.43 Freaky Science★
- p.46 Nuts & Dolts

In which we visit the pyramids of Giza, witness top architecture marvels by animalia, know how civilizations express themselves through architecture and a lot more...



Sherlock
Holmes tells
Kumars...

MORE PRIZES!

- Web only
- Magic Science★
- p.31 Super-Scientist★
- p.42 Smartenstein★
- p.42 Treasure Hunt★
- p.47 Sci-Q Time★

COMICS

- p.08 History Maker
- ▲ p.10 Toon Talk
- p.20 Science Fiction
- p.38 The Smarties
- p.44 Multiverse

FREEBIES

p.24 Poster
Web only content
bwmag.in

FUN-DO & LEARN

- p.06 Toybox★
- ▲ p.05 Eye See★
- ✚ p.40 DIY★

READER CONTRIBUTION

- p.30 Letters From Readers
- p.30 Solutions & Winners

MEET THE SMARTIES

Beyond the skies, trouble brews.
Danger awaits us, all humans!
Sneaking and lurking in the dark,
Someone's plotting to tear humanity apart.

Much before they act, our friends arrive to
thwart the attack,
1... 2... 3... Go! The Smarties arrive fast.
Yes they are here, look!

The Smarties rarely punch down opponents -
they are peace lovers.
They use not only brawn, but also brains!

The battle's won; let us meet them now,
They are real heroes - take a bow!

Dr. Dodo, dear friends,
is the only **Dodo** alive.
The wise elderly scientist,
his ideas save many a life!



Skree! is mysterious,
a bearded Toda lady.
Up her sleeves,
she has tricks aplenty!



Young Arby is the great
Indian mathematician.
Sucked into BW Labs by
Dr. Dodo's time-machine,
Grow up to be Aryabhata,
yes he will fine!



Young Alby's none other
than Albert Einstein.
Sucked in time by
Dr. Dodo's Galileo one,
He will soon change the
history of science!



Mr. X is the antagonist,
Top IQ of the universe
is his! Opposing ideology
than the Smarties,
Is he good? Is he bad?
You analyze.



Earth, wind, water and
fire combine to make
Bhoo - an enigma,
She is a superhero -
every villain's dilemma.



Now that you know them, see their wonders,
The episode begins, the Earth's saved
from plunder.



Slippery slope

by Kayomarz Bacha

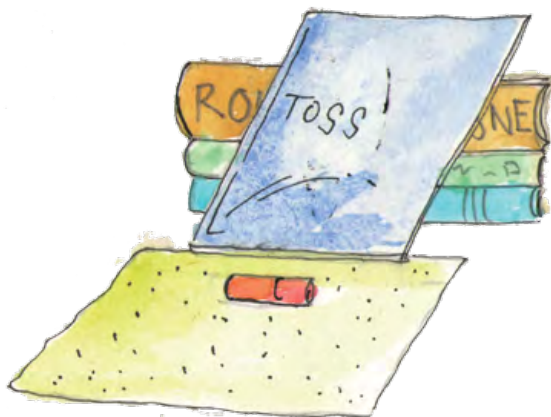
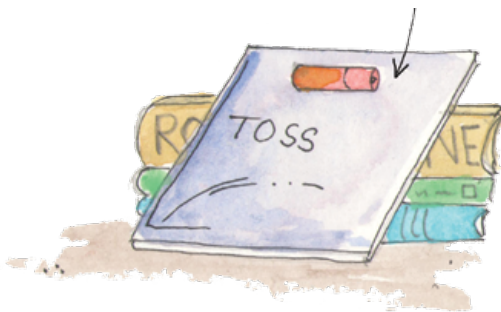
Make an inclined plane on a table or a floor, using some books. Now, slide a pencil cell (AA battery) across the inclined plane such that it rolls on to the smooth surface of the table (or floor). How far does the battery roll before coming to rest? Make a note of that point and distance.

Then, spread a piece of cloth on the surface beneath the books and inclined surface, and

repeat the same activity. Measure the point and distance the cell rolls to again.

NOTE: Make sure that there are no wrinkles on the cloth. Also, ensure that the angle between the inclined plane and the surface remains the same during both runs of the test.

Is there a difference between how far the battery rolls the two times? Why? ■



Research and email your answer to brainwave@ack-media.com to win the latest ACK comic. Also mention how the science phenomenon related to this is relevant in our day-to-day life.

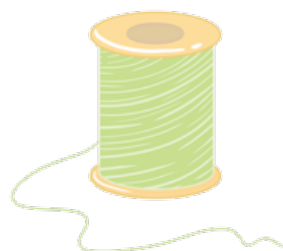


Let's work Smart

Do you want to work smart, or work hard? This experiment is about working smart. by Pushkar Samant

You need:

- 5 rubber bands
- A heavy object (a water bottle or a box filled with pebbles)
- String



Method:

1



Tie the rubber bands together vertically and a rubber spring.

3



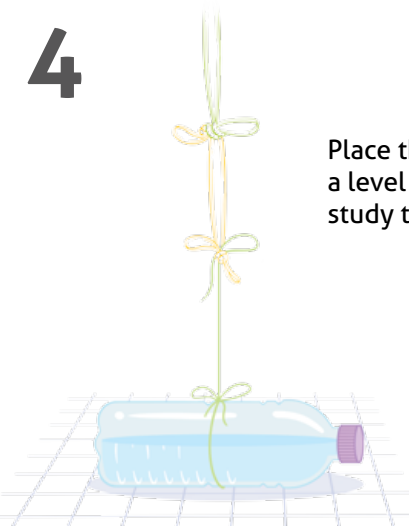
Connect one end of the rubber spring to one end of the string.

2



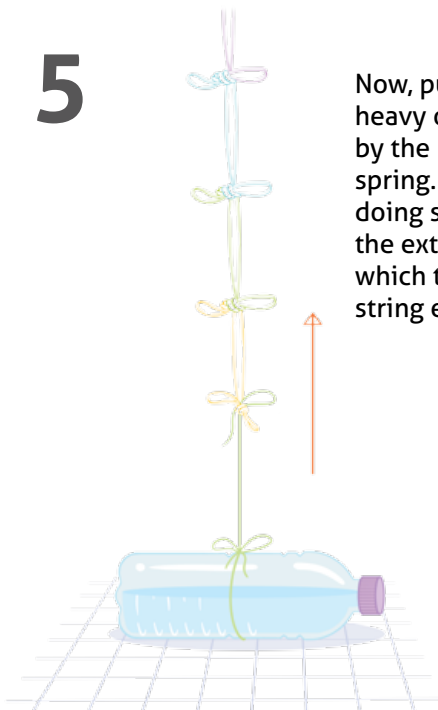
Tie the other end of the string to the heavy object.

4



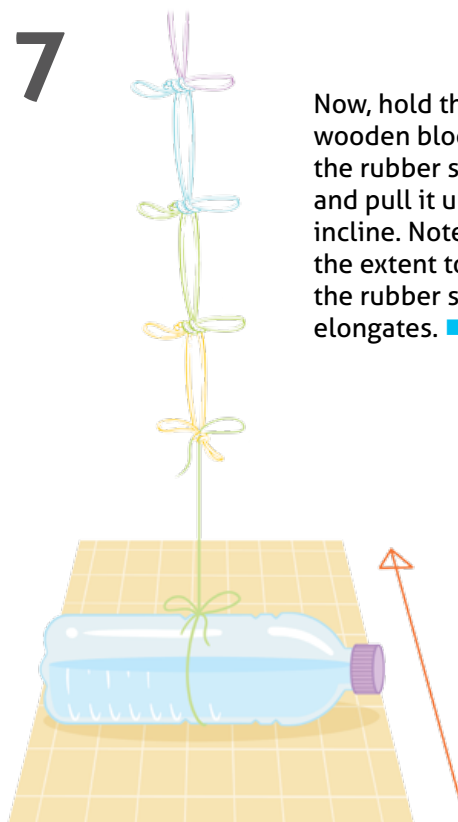
Place the object on a level surface (floor, study table, etc.)

5



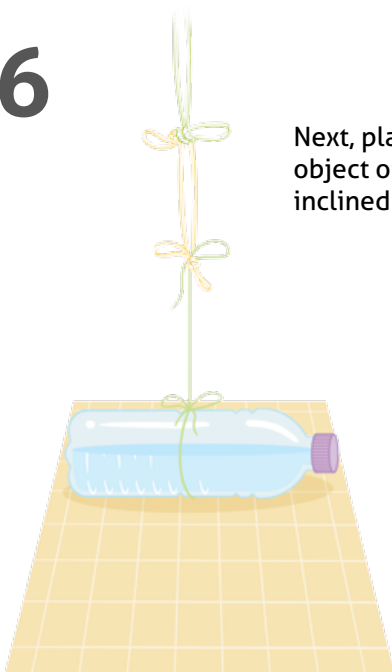
Now, pull the heavy object up by the rubber spring. While doing so, note the extent to which the rubber string elongates.

7



Now, hold the wooden block by the rubber spring and pull it up the incline. Note down the extent to which the rubber string elongates. ■

6



Next, place the object on an inclined surface.

What do we observe?

The force you need to apply is less when the object is pulled along an inclined surface (when compared to the force needed to lift it up directly).

Hence, if we use an inclined plane, less energy is needed to lift heavy objects. It was by using this technique that heavy stones were used to build magnificent temples in ancient India.

What is the relation between force and energy? Research and email your answers to brainwave@ack-media.com to win a cool ACK comic book!



Be an

Written by Sasikanth C

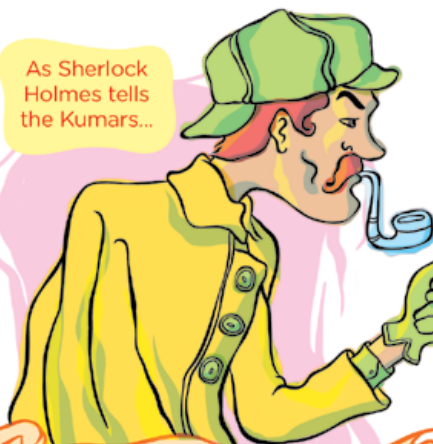
Artwork by Agustín Dib

ARCHITECT! BUILD

The

WORLD

As Sherlock Holmes tells the Kumars...



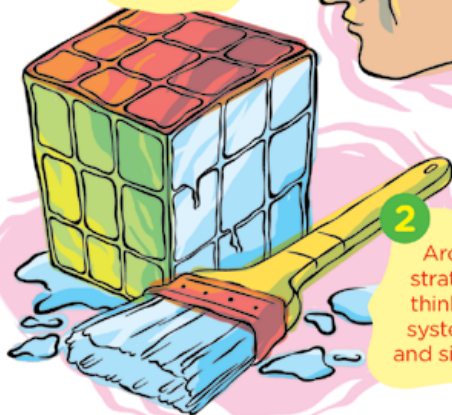
Humans are mortal, but wish to live forever. They do this through 'culture'. And what can reflect the culture of a civilization better than architecture?

If that isn't Reason enough For you to choose To Be an Architect, I have 100 MORE! But since space is of constraint and The Editor Refused To Allocate 20 pages to This article, I AM LISTING OUT the TOP 8.

1 Architects balance multiple intelligences, including spatial intelligence. They are technologists, artists, engineers, scientists, historians, craftsmen and more!



2 Architects are strategists. They think in terms of systems, laterally and simultaneously.



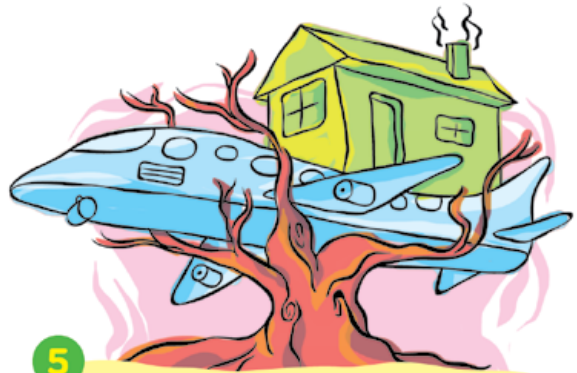
3

Architects transform chaos into order, and give the world a meaning.



Architects are 'whole brain thinkers' -
They use the left side as well as the right

4



5

Architects can turn used, old and broken
stuff to create something amazing to live in!

Architects are problem solvers
and change agents. They use
all media and dimensions.

6



7

Architects are visionaries -
they see what none of us can,
and build it.



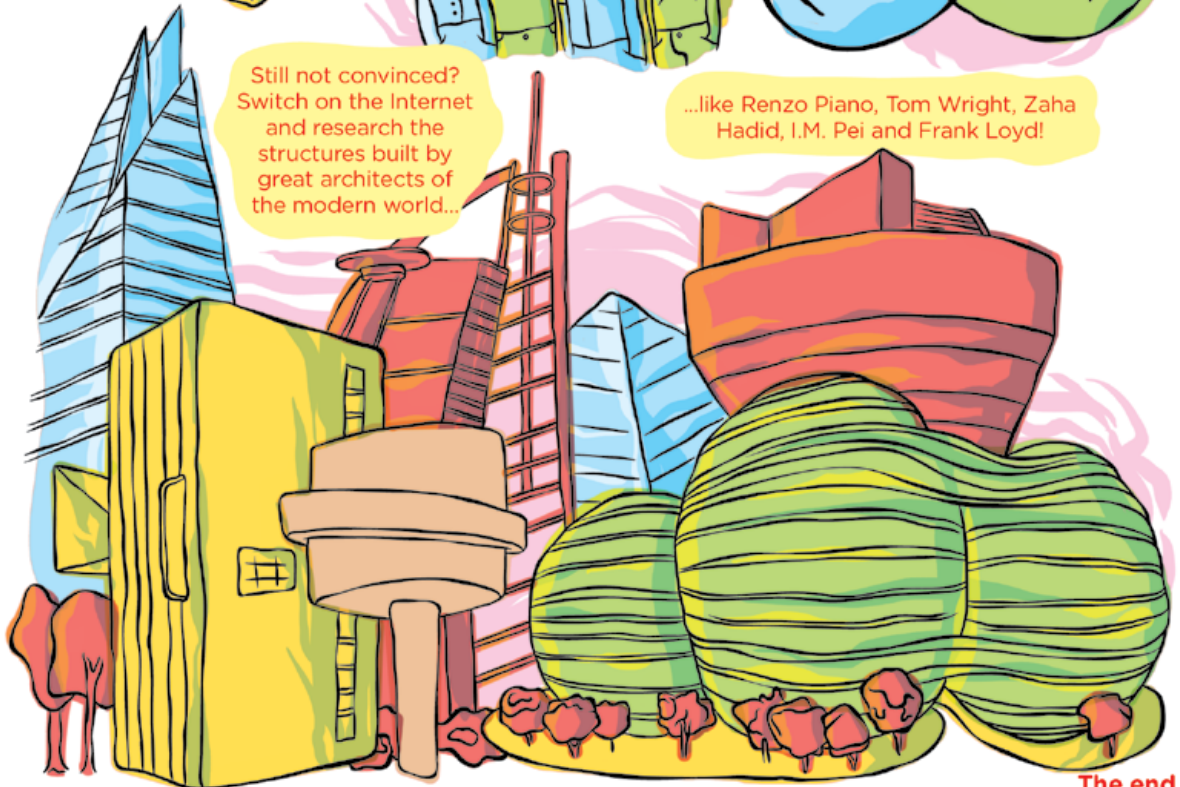
8

Architects connect the past
with the present and the
future.



Still not convinced?
Switch on the Internet
and research the
structures built by
great architects of
the modern world...

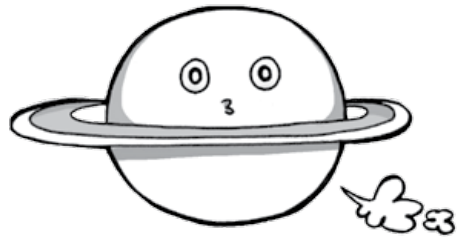
...like Renzo Piano, Tom Wright, Zaha
Hadid, I.M. Pei and Frank Lloyd!



The end.



The caterpillar's only purpose in life is to eat! It does not rest, hunt, make a home or reproduce like other creatures do. From the moment it hatches from the egg, the caterpillar starts eating. Within 20 days, it grows 10,000 times bigger. If we do this, we would be as big as the Empire State Building!



A gas giant is a large planet that is not primarily composed of rock or other solid matter. There are four gas giants in the Solar System: Jupiter, Saturn, Uranus and Neptune.



Did you know that there are no cyclones near the Equator? And that cyclones always spin anticlockwise in the Northern Hemisphere of the Earth, and clockwise in the Southern Hemisphere?

An Old Teapot

Once known as the Koffee Pot Cafe, the 82-year-old teapot shaped building in California has now been termed a public nuisance. A report stated that the building at 957 E. Fourth St., which is a designated historic landmark, has become 'substandard and a public nuisance'.

Long Beach Heritage President, Melinda Roney said that her organization is working to

save the forgotten building that exemplifies the type of architecture known as 'programmatic' or 'theme buildings,' which was popular in the 1930s and 1940s. She added that the coffee pot-inspired building is the only example of programmatic architecture left in Long Beach. Others have been destroyed.

This piece of architecture was built at a time when many

merchants opted for odd-shaped buildings that could catch the eyes of motorists passing by.

The Koffee Pot Cafe has been featured in several architectural guides, including 'California Crazy' and 'Long Beach Architecture: The Unexpected Metropolis'. ■

Source: presstelegram.com

Titanic in a Theme Park?

China now plans on having a life-sized replica of the Titanic in their soon-to-come 'landlocked theme park'. The park will also feature a museum and a shipwreck simulation to give visitors a sense of the 1912 disaster.

This Chinese version of 'the unsinkable ship', with a price tag of 1 billion yuan and an expected opening date in 2016, will be built at least at a distance of 930 miles from the nearest ocean in the central province of Sichuan.

Su Shaojun, chief executive of the Investment Group that funded the project, thinks Asia needs its own Titanic museum.

The project aims to be more than a museum that replicates the original ship and the 1997 movie that became a global hit. The simulation will allow several hundred people (at a time) to feel what the shipwreck was like.

"When the ship hits the iceberg, it will shake, it will tumble," Su said. They will create the effect of water gushing in so that people think, "The water will drown me, I must escape!" ■

Source: reviewjournal.com



Image Source: Wikimedia Commons



Artwork: Parnati Pillai

A visit to the museum

Vicky has turned 14 today. But he doesn't want to celebrate it in the typical way. So, he finds for himself, something cool to do and someone great to meet!

.....
by Priyanka Talreja & Sasikanth C

Vicky had a love for structures that was inexplicable. Every time he would walk out, he couldn't take his eyes off the tall buildings. He always wanted to know what goes into making structures which are so strong that so many people to live in them.

This was his only dream - to grow up and build homes for people. Big homes, small homes, cool homes, unique homes... just homes.

That day was very big for Vicky. It was his 14th birthday and he was going to the museum of structures to understand how they work!

Vicky left his house on a bicycle - he was now big enough to travel alone.

The museum was not too far from Vicky's home. Just a left turn followed by one right turn and there on, it was just a straight road, right till the end.

He reached the destination within twenty minutes. He could feel his excitement build. He quickly parked his bicycle, purchased the ticket and walked in - superfast, as if

someone would rob him off the change if he doesn't!

He checked the map of the museum to find out where the structures of Egypt were exhibited - second floor, third room. Without much ado, he headed towards it.

Vicky entered the room and saw just what he expected to - a replica of the Great Pyramid of Khufu! He had seen the pic of this structure on TV and it intrigued him to a great extent. More so, because a lot about the pyramids is a mystery till date.

As Vicky was gazing at the pyramid, mesmerized, he heard a voice behind him - "Do you know what this is?"

Vicky turned to see a very old, frail man standing right behind him. He had a bald head, rough beard and a great hunch.

"Yes, I do. This is a replica of the great pyramid of Khufu," replied Vicky.

"Ah, yes. What else do you know about it?" the man asked.

"This was King Khufu's tomb," said Vicky confidently.

"If that is all you know, you know very little, dear child!" exclaimed the old man. "Let me introduce myself. I am the guardian of this place. It's my passion to ensure that every child who steps in to view this exhibit leaves with enough knowledge that matches his or her curiosity."

"That's awesome! Please tell me all about the great pyramids," screamed Vicky, in great excitement.

"Sure, I will tell! But first, let me find a chair to sit. I need to rest this old soul as this will be one long conversation," said the old man and pulled up a chair from a corner.

Once they were seated, he began like he was narrating a great story - "This is one of the pyramids in the Giza pyramid complex. Situated on the western bank of the Nile, Giza is the most famous group of pyramids in the world. Of these, Khufu's pyramid is the grandest and most elaborate one ever built."

"How can a tomb be grand?" asked Vicky, as curious as ever.

"Well son, pyramids were more

than just tombs, especially this one. This housed not just Khufu's tomb, but is also layered with a fully functional arrangement of chambers and passages.

These chambers are the most amazing wonders of science, as they are built at the centre of the pyramid, about 90 meters below the vertex.

Imagine being in one of these chambers and looking up to see a huge mass of rocks above you, not supported by any pillars!" the old man paused to catch his breath. He seemed as excited as Vicky was, if not more!

"Phew! That sounds very intimidating. What if the ceiling caves in, and all of those heavy rocks fall on us?" squealed Vicky, in horror.

"That's the beauty of these structures, young friend. Their walls have been built with tiered steps, layer by layer, till the rocks meet each other. This gives them unprecedented stability," explained the old man.

"Back then, they didn't even have earth excavators and cranes. Building such magnificent structures would have been really difficult. No?"

asked Vicky.

"You're right. The kings would start building their pyramids as soon as they took over the throne. It took over 20 years and 30,000 workers to construct this one!

It was originally 146.5 metres high. Each base was 230.4 metres long. The mass of the pyramid is estimated to be 5.9 million tonnes! So, the volume is roughly 2,500,000 cubic metres.

Based on these estimates, building this pyramid in 20 years involved installing



approximately 800 tonnes of stone every day. Similarly, since it consists of an estimated 2.3 million blocks, completing the building in 20 years would involve moving an average of more than 12 of the 1.5 tonne blocks into place each hour, day and night!"

"Wow!" said Vicky in awe. "Those folks must have been brilliant architects."

"It's not just architecture, son. It's science. This pyramid was so well planned that it was the tallest man-made structure in the world for over 3,800 years!" said the old man with pride, as if he built it!

"How is science involved here? I study it every day. I don't think science has much to do with this!" protested Vicky

"Habibi, science is behind everything we do. Only then do things fall into place. Let me give you an example. Did you know that in this pyramid, there are weight-relieving chambers? These have been built to distribute the weight of the overlying rock across the structure uniformly, to prevent the king's chamber from being effected," explained the old man.

"Now that you've given an example, it makes a lot of sense. There is science behind everything we see and do, even if it isn't seen. Could you please tell me more about these pyramids?"

"It sure has a lot. Let's begin with the primary burial chamber, or the king's chamber. It contains the sarcophagus i.e. tomb that held Khufu's body. There is a smaller, queen's chamber right under the king's chamber.

There's also a gallery that is a large passageway with a vaulted, corbelled ceiling.

Then are the descending and ascending passageways that connect various chambers to each other, and to the outside.

This pyramid also has air shafts that connect the king's chamber to the outside. It's said that these have been designed as a way for Khufu's spirit to exit the pyramid and rise to the heavens!"

"So very interesting!" exclaimed Vicky

"And you know what? These were built around 2500 B.C! They did not even have proper measuring instruments then. They used nothing but the length from the tip of their middle finger to the elbow, to measure length. They used the width of their hand, with the thumb on the side, to measure smaller distances.

And those measurements were extremely exact! For instance, the base of Khufu's pyramid is level to 2 centimetres. See? That needs a great practise of science," added the old man, brimming with pride again.

"Everything's so perfect, standing tall even after 4500 years!" he concluded.

Vicky was just amazed. He was learning so much about these structural marvels. He wanted to know more. Just as he was framing his next question, he felt his waist-pack vibrate. He dug into it to fish out his birthday gift, his new mobile phone.

He had received an SMS from his mother. He had gone for hours and she wanted him to return as soon as possible, before sunset.

When he looked up, the old man wasn't there! He could see only the empty chairs. There was, instead, a note on the chair -

I am Khufu and I can see that you will grow up to become a great architect. Study your science well, for that will form the base for your future. Look at your textbooks a little differently. Enjoy them and you won't regret. Continue being curious and asking questions.

Vicky wouldn't normally believe in spirits. But, he had experienced this himself! And he had realized long ago that humans know so little science that one can't say for sure what's possible and what's not.

"So, that's how the old man knew everything about the pyramids!" Vicky reasoned, picking himself up and heading home. ■

Hilly areas

Houses in hilly areas have really sharp, pitched roofs.

Material used in pitched roofing is steel or wood.



This roof is sloped to a degree of 10 or more from the horizontal level.

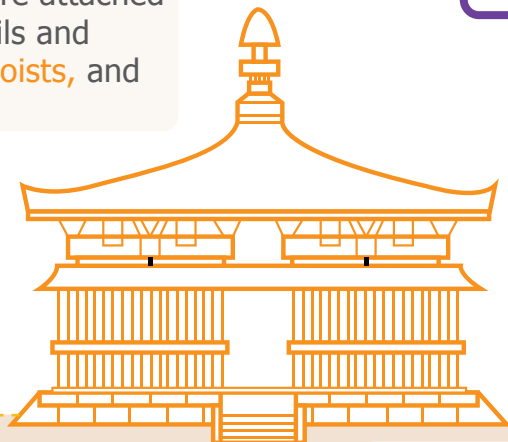
These structures are constructed in mountainous regions that receive heavy snowfall. These roofs allow the snow to slide off, ensuring that it doesn't collect on houses.

Earthquake-prone areas

In wood-framed structures such as pagodas in Japan, planks are secured to the floor with anchor bolts and the framework of homes is built on that.

Wood and siding panels are attached to the framework with nails and screws, followed by roof joists, and the roof.

When an earthquake occurs, the entire structure moves from side to side ensuring that it stays secure.



In an earthquake, the ground rocks and twists violently, causing regular structures to get torn apart. Wooden frame buildings prevent this.

THE SC

s t r u

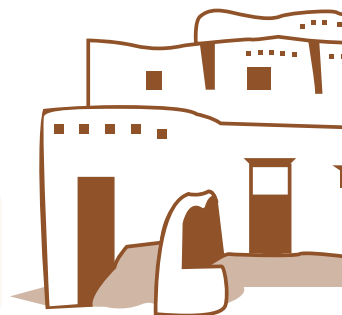
by Priya

*I am wind. I travel to across
feel the heat and at other time*

*But everywhere I go, I am
adapt to cha*

Desert areas

In deserts, nights get too hot. So houses are built. They are made



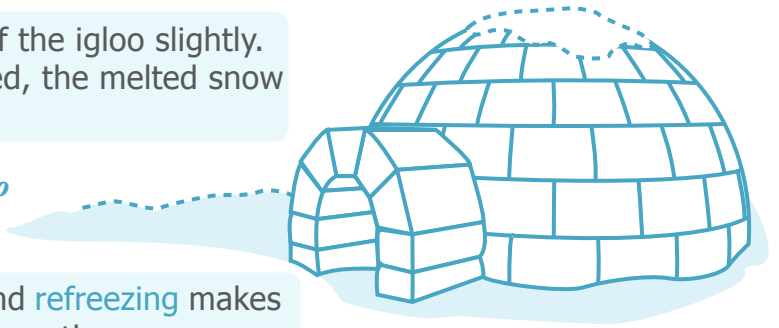
Snow-laden areas

Igloos are one of the simplest, but most amazing structures ever built. With a small oil lamp and body heat, an igloo can warm up to 40° (above the outside temperature!) If the temperature outside is -5°C , the insides can be at 35°C .

The heat inside melts the inside of the igloo slightly. Then, when the igloo is unoccupied, the melted snow freezes into ice again.

Insulation capabilities of an igloo can increase over time.

This gradual process of thawing and refreezing makes the structure very strong and warmer than ever.



EXPERIENCE OF

culture

Anka Talreja

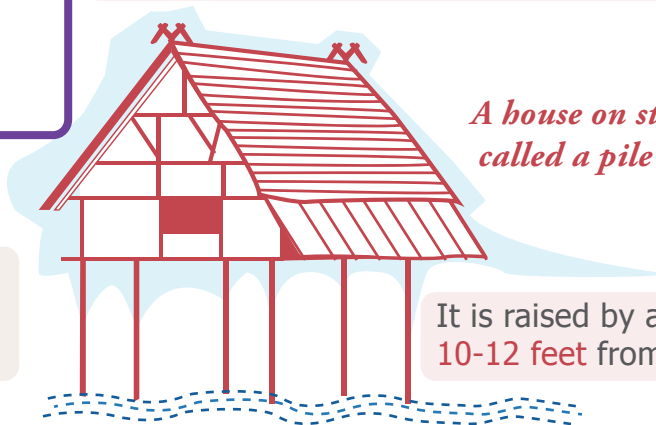
*lands. I sometimes make people
s, I send chills down their spines.
amazed at how humans can
enges in nature!*

At very cold and days are called adobe houses are of mud.



Flood-prone areas

To protect themselves from the wrath that a flood could bring, humans began constructing their homes on stilts.



A house on stilts is also called a pile dwelling.

It is raised by a height of 10-12 feet from the ground.

During the day, mud walls restrict sun rays and don't let the insides of a house get heated up.

At night, these walls retain the heat collected during the day, Keeping the insides warm and cosy for several hours.



Move it

by Alby

The first ever crane was constructed to draw water out from a well!

Humans have used a wide variety of devices to move heavy objects, since ancient times. One such device, which reduced the workload big time, is the crane. One of the earliest versions of the crane is 'shaduf'. It was used in Egypt about four thousand years ago, to move water! It is still used in rural areas of Egypt and India.

The shaduf consists of a long, pivoting beam balanced on a vertical support. A heavy weight is attached to one end of the beam, and a bucket is attached to the other. The user pulls the bucket down to the water supply, fills it and lets the weight pull the bucket up. The beam is then rotated to the desired position, and the bucket is emptied.

Earlier, cranes were constructed from wood. But with the advent of the industrial revolution, cast iron and steel took over.

For many centuries, power was supplied to cranes by the physical exertion of men or animals. Mechanical power was first provided by the steam engine. Steam cranes came into use in the 18th century.

Today, cranes generally use electric motors and **hydraulic** systems to have a much greater lifting capability. ■

The word 'crane' is taken from the fact that these machines have a shape similar to that of the tall, long-necked bird of the same name.

What's the scientific difference between a crane and a hoist (e.g.: pulley)?

Research and email your answers to brainwave@ack-media.com to win a surprise gift.



Ancient scientific wonder by Arby

It was Maharaja Jai Singh's fascination for mathematics and astronomy that gave birth to the astronomical wonder called the Jantar Mantar. Read on to know more!



The Samrat Yantra

A lot like Fred Flintstone's watch, the Samrat Yantra is a 90 feet high sundial that has been built to indicate the solar time or the local time of a particular place. This kind of a dial is also known as 'equinoctial'. The time can be measured by observing the shadow cast by this dial due to the Sun.

The Misra Yantra

This was designed to determine the shortest and longest days of the year. ■

It was post 1724 that Jantar Mantars were constructed at various locations in India - Delhi, Jaipur, Mathura, Ujjain, and Varanasi.

These observatories were constructed for the primary purpose of compiling astronomical tables to predict time and movements of celestial bodies.

Let's take a closer look at some of the structures in Jantar Mantar.

The Jai Prakash Mirror of the Heavens

This is one of the most

elaborate and complex instruments built between 1727 and 1733. It is a hemispherical dial that helps us measure many quantities (such as altitude and position) of celestial objects. Built in the shape of a bowl, partly above and partly below ground level, this 'yantra' makes for one intriguing sight.

Ram Yantra

Designed as a cylindrical structure, the Ram Yantra is an instrument that measures the altitude of the Sun. Prior to its creation, there were no instruments like the Ram Yantra in any Indian school of astronomy.

Did you know:

- Due to great maintenance standards, the Jantar Mantar at Jaipur has been declared as a world heritage site.
- 'Jantar' stands for 'instruments' and 'Mantar' means 'formula'.





The Time Travelling Kumars

Sherlock Diaries 14

Written by:
Sasikanth C

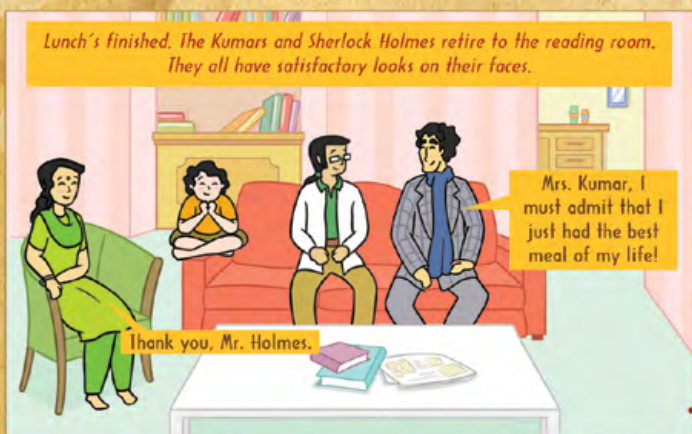
Illustrated by:
Pooja Prabhakaran



Previously...

Sherlock Holmes has travelled to 2014 with the Kumars. They have many interesting discussions about how technology has evolved since his time. Over lunch, they discuss the food we eat, hygiene, and using all our senses to relish food and spices.

Lunch's finished. The Kumars and Sherlock Holmes retire to the reading room. They all have satisfactory looks on their faces.



Mrs. Kumar, I must admit that I just had the best meal of my life!

Thank you, Mr. Holmes.



Mom! Just a 'thank you'? Just a 'thank you'?

Well, what do you want her to say, son?

Mom, Mr. Holmes is one man who starves himself at times. In 'The Adventure of the Norwood Builder', Mr. Watson mentions this explicitly.



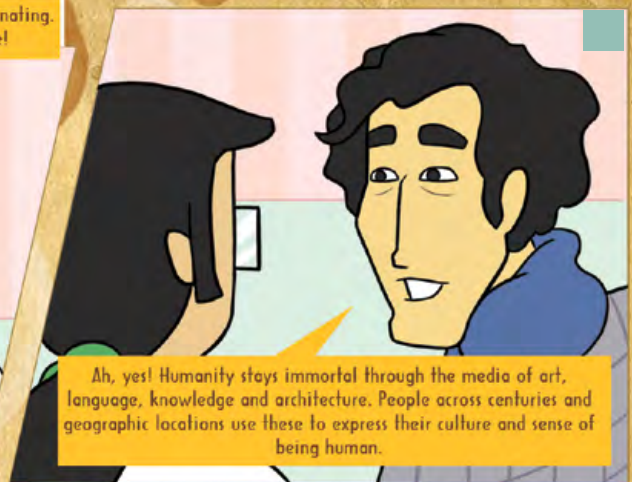
Oh, yes! Mr. Holmes does not believe in using his energy, nerve force and blood circulation for digestion, when he needs it for his brain!



So, coming from him it is a huge compliment!

er...

Well, looks like I have to change the topic. Even for me, the praise is getting too embarrassing!





The lady studying structures

by Pushkar Samant & Priyanka Talreja

Shraddha Hemant Bhatawadekar is an archaeologist researching historic architecture. She has been involved with heritage management and built heritage conservation for several years, and has worked on numerous historic buildings and World Heritage Sites. She also conducts walks in the city of Mumbai to spread awareness about its heritage and significance.

When and how did man feel the need to move out of caves and stay in independent, self-built homes?

In the early years i.e. Palaeolithic period or early stone age, man was a hunter-gatherer. He moved from place to place in search of food. He didn't have any permanent housing. He took shelter in natural caves.

As humankind progressed, man started farming and domesticating animals. This was the Neolithic period or the New Stone Age, started probably about 12,000 years ago.

This period was marked by better and favourable climatic conditions. The shift from food gathering to food producing required man to spend more time at one place. Man started living in communities and gradually built localized permanent dwellings.

He built from naturally available material such as mud, stone, wood, grass, straw, etc. This was a significant stage in human history as it gave rise to settlements that were to bring in further socio-economic-cultural progress in human life.

Ancient civilizations built a few structures that still seem complicated to the modern man (Pyramids, Stonehenge, etc.) Do you think that these heritage structures were more advanced than the modern ones?

It might not be appropriate to say that the heritage structures were more advanced than the modern ones. You have to remember that every construction is the product of a particular period, technology that was available during that period, and the availability of construction material.

It is also an ultimate outcome of a thought process that was prevalent in the particular society.

Technology advances from time to time and therefore, different technologies are employed in newer constructions. As centuries pass, some skills become redundant and hence, lost in time.

Historians have discovered that certain monuments still remain a puzzle due to the lack of knowledge and understanding of the technology, ideas and thoughts during those periods.

Continued on page 27

SCIENCE OF STRUCTURES

From the House of Analog Construction, Inc.™
BRAINWAVE™
SCIENCE IS JUST A GAME



SCIENCE OF STRUCTURES







BRAINWAVE™

SCIENCE IS JUST A GAME

Could you share a few characteristics of forts built for emperors in ancient India?

India has many forts such as hill forts and sea forts. These were built mainly for defence purposes. They are usually characterised by high walls, a series of gateways with spiked doors, bastions, etc. - all meant to ensure protection of the inhabitants of the fort.

In order to deceive enemies in case of an attack, some tricks were used in the construction of forts. An important addition used to be that of a moat filled with water encircling the **ramparts**⁶. this increased the height of the ramparts and made undermining virtually impossible.

In Daulatabad Fort, a long tunnel was created as the only access to reach the inner citadel. There were many obstacles for the enemy - darkness, unevenly cut steps, inlaid iron spins, etc.

Provisions were made to fill the tunnel up with smoke or hot oil or water from above, which made it unpassable for enemies.

In Golconda Fort, buildings were planned and constructed in such a way that they could deflect sound. Therefore, a clap by a guard at the entrance could be heard on the hilltop that was 400 feet away! This signalling device alerted guards well in advance, before enemies could reach the top.

Such techniques made the forts impregnable and hence, couldn't be easily conquered by enemies.

Which according to you is the best wonder of the world, in terms of construction?

There are many structures in the world that are superb examples of human creative and engineering genius.

I am really fascinated by the Eiffel Tower, which is located in the city of Paris in France. It is a world renowned icon, visited by millions of people every year. Constructed in 1889 for the Universal Exhibition celebrating 100 years of the French Revolution, this structure was named after Gustave Eiffel, a principal engineer who was a mastermind in its construction.

This structure was completed in a record time of 2 years, 2 months and 5 days. Made entirely of wrought-iron, this

gigantic tower rises over 1000 feet. Imagine standing before an 81 storeyed building.

As many as 5300 drawings were made to ensure accuracy while constructing it! It weighs 10,100 tons and consists of over 18,000 metallic parts! Lifts to go to the top were installed right in the beginning. The tower is painted every seven years in order to protect it from rusting.

The Eiffel Tower is a product of



industrialization that marked tremendous progress in the field of **metallurgy**⁶ and is a veritable technical feat.

What according to you is the most intriguing structure ever built?

Ancient civilizations built many structures for housing, praying, entertainment, burying the dead, etc. Scientists and historians are still trying to solve mysteries of the construction of many such structures, as well as different practices associated with them.

The pyramids of Giza in Egypt are perhaps one of the most studied, but still the most intriguing structures. These pyramids, built some 4500 years ago, were used to bury the dead rulers (Pharaohs) and their consorts.

The rulers built these pyramidal shaped tombs for themselves. They filled them with all the things the ruler might need when he would enter the next world, after his death!

Pyramids provide a lot of information about the rulers, their lifestyles, beliefs and practices of the Egyptians, etc. There are over 100 pyramids found in Egypt. The largest pyramid in Giza is 481 feet high. 2.3 million i.e. 23 lakh stone blocks were used in its construction!

Each stone weighed 2.5 to 15 tons. Many questions about the construction of these tombs which are still unanswered. These impressive structures have been termed as one of the wonders of the ancient world.

Can you explain the scientific factors that need to be considered while designing

buildings?

Many scientific factors need to be considered while designing buildings. The foremost consideration is that of the local environment. Weather conditions, sun, wind, rain, temperature, humidity, etc. need to be studied so that buildings are not affected by these factors and at the same time, could be optimised.

Then, geographic conditions such as seismic activities, soil, etc. need to be understood.

Characteristics of materials as well as principles of acoustics, chemistry, and physics concepts such as load, friction, gravity, ductility, etc. also play a significant role in construction.

Human comfort and safety, energy consumption, and durability of construction are also as important as anything else to consider.

Skyscrapers are a prevailing trend today. Could you explain the pros and cons of these?

Skyscrapers are tall buildings of many storeys, with a steel framework that supports curtain walls i.e. outer covering of the building. Skyscrapers rise higher than other buildings in the area. They dominate the cityscape and also help create an image of the city.

Burj Khalifa is an example of this. Located in Dubai, this is the tallest man-made structure in the world. It has 163 floors and has become synonymous with Dubai. It took over five years to build the Burj Khalifa!

Skyscrapers are the best solution when land is expensive. Going 'up' provides more habitable floors while consuming less land. Technological innovations in construction allow them to be stronger and efficient. However, the tremendous load on the building from the tension of the material, wind pressure, **seismic activity**⁶, large requirement of building services and safety seem to be some of the issues that engineers have to tackle while building skyscrapers.

Technological failure could affect the building services to a great extent. Building skyscrapers involves huge cost. Hence, these are mostly seen in large cities where such costs are affordable.

Keeping the scene from the movie 'Swades' in mind (in which Mohan tries to explain his work at NASA to villagers) - how would you explain your work to a common man?

I am an archaeologist. Archaeology is the study of human past i.e. how people lived, their practices, beliefs, food, lifestyle, culture, tools and technology, etc.

Information is collected through objects found in explorations and excavations. Excavation is an act of systematic digging to discover traces of human activity in the past.

Objects found include bones, tools made of various stones, art objects, seals, pottery, grains, beads, bangles, ruins of houses and larger cities, etc.

In other words, my work is akin to a detective trying to find clues to solve a mystery, and complete a puzzle of the past.

Archaeologists also work towards the protection and preservation of objects of the past, and to create awareness among people about the importance of history and objects of the past.

Would you recommend your career to others? What attitude is needed to excel in that field?

Yes. I will surely recommend my career to others. It is always exciting to discover objects that were in use once upon a time. These can, today, tell us about the life of ancient humans.

What's needed to excel in this field is tremendous patience and hard work. Passion and enthusiasm to discover, preserve and protect the past are also a must. ■

What are the seven most popular wonders of the modern world? And what are their structural specialities?

Research and email to brainwave@ack-media.com to get a chance to win a cool 3D puzzle!

Winners of various activities in the May 2014 issue are:

Treasure Hunt: **S Harshini**

Toy Box: **Jessica Chris**

Most Loyal Reader: **Vaman N & Abishek D**

Fan Fiction: **Shivank Kacker**

Eye See: **Riya Bajaj**

Science Fiction: **Vaishnavi Menon**

Sci-Q Time: **Dakshayini Hosmani**

DIY: **Abishek Devendran**

Super Scientist (Youtube): **No one**

The BW Smartenstein title, certificate and mystery gift go to **S Harshini**

For more details about smartenstein, visit - www.bwmag.in/category/bw-smartenstein

All participants, please note that you have to send in your entries with the right subject line, your picture, age, school, complete address (along with pin code), and phone number. Entries without these details often get lost in the heaps of emails we receive. Don't risk it!



Letters from Readers

Guys, you have an awesome magazine. I love it. It's better than any magazine I've read. Please introduce more competitions. And please include more content so that it becomes even better! My first magazine was Vol.3 Issue 6. I loved the content about food. Thanks for such an amazing magazine. Keep up the good work!
Divy Tandon – via facebook

Dear Divy,
Great to hear from you. You mean you need more than 10 contests in an issue!? If we indeed do so, would you have enough time to go to school, or play outside? :)
SK, Editor

As a student board member, I really think

that the BW team is not giving us much of an opportunity. I really wish that we soon have something to do with the magazine - maybe a bit with the design of the magazine, suggesting a topic for the month, etc.
Pratul Venkatesh – Via email

Dear Pratul,
Good and constructive feedback. Thank you! As soon as you all finish the current task, we will put your suggestions into action.
SK, Editor

Hi, I love reading Brainwave than anything. Please make the Smarties more interesting. Thanks for publishing the truth behind energy drinks. I seriously didn't know about it! Tongue freeze had happened to me once. Now, I understand why! Then, I tried again and these are the words I couldn't pronounce - tongue, twister and pencil. That's all because I didn't know what more to say.
Hirran – Via email

Dear Hirran,
That's cool. Keep actively participating in as many contests as you can. Regarding Smarties, this is the final introduction episode. The story gets spiced up from the next!
SK, Editor

**Now, get
more bang
for your
buck!**

Visit our website for
extra content every
month - exclusively
for our readers!

Visit www.bwmag.in/category/web-only-articles

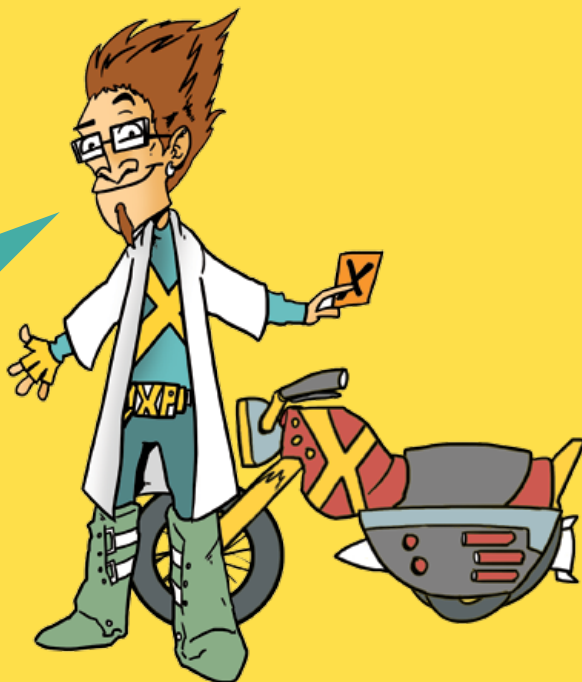
Be a super-scientist:

Perform a cool experiment
and email the video or
step-by-step pictures to
brainwave@ack-media.com

The best entry will be published
on our video channel and
awarded a surprise gift worth
Rs. 250 - every month!



www.youtube.com/brainwavemag



Artwork: Abhijeet Kimi



Let's fly with July

by Priyanka Talreja

Here's all the science awesomeness that July has to offer. Take note and go for a sci-ride!

Looking back in history, there are some very path breaking events that took place in July!

Let's check them out:

July 4, 2005 - A NASA probe is crashed into a comet, in a quest to know more about the origins of our Solar System.

July 4, 1997 - NASA Pathfinder probe lands on Mars.

July 6, 1997 - Pathfinder begins exploration of Mars.

July 7, 1981 - First solar powered flight across the English Channel.

July 9, 1972 - Voyager 2 makes closest approach to Jupiter.

July 4, 1954 - Astronomers record a **supernova stellar explosion**⁶. ■



Image Source: Wikimedia Commons

Star House

by Pushkar Samant

Let's have a look at a few cool celebrity homes.

Celebrities are choosy when it comes to picking up a home to live. Some prefer 'homely' while others go for 'lavish'.

and making it completely waste-free.

Isn't it nice when celebrities care for the **environment**? ■

Eco home

Gisele Bundchen and Tom Brady have built a cool green home for themselves. 90% of the materials used to built it are recycled or antique. They installed solar panels on the roof and built a chicken coup that gives them their daily supply of eggs!

This couple has been working on this dream home for five years!

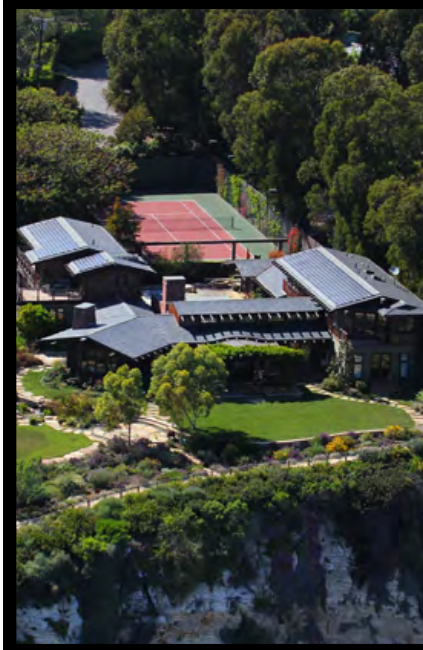
Home on the airport

Pulp Fiction star John Travolta's Florida mansion has the appearance of a mini airport when you look at it from the sky, largely due to the private Boeing 707B parked outside. The star had this driveway specially designed so that the plane could taxi right up to the house.

Could things get crazier?!

Waste Free

Julia Roberts' Malibu home isn't just luxurious, but also eco-friendly. The actress recently gave it a green makeover that included installing solar panels





The natural wonders of the world

We have read enough about architectural wonders of the human world. Now, let's read about structural marvels built in the world of animalia!

by Dr. Dodo

Honey Comb

Honeycombs are the most intricately designed creations of nature. Each waxy cell is a meticulous, flawless hexagon. Its six wafer-thin sides provide not only strength to the structure but also the smartest way to store more honey!

For thousands of years, thinkers have wondered how these structure come into being so flawlessly. Finally, recently, researchers at the Cardiff School of Engineering (with coauthors from the Beijing Institute of Technology and Peking Univeristy) have been able to put forth the exact method used by bees to build their combs.

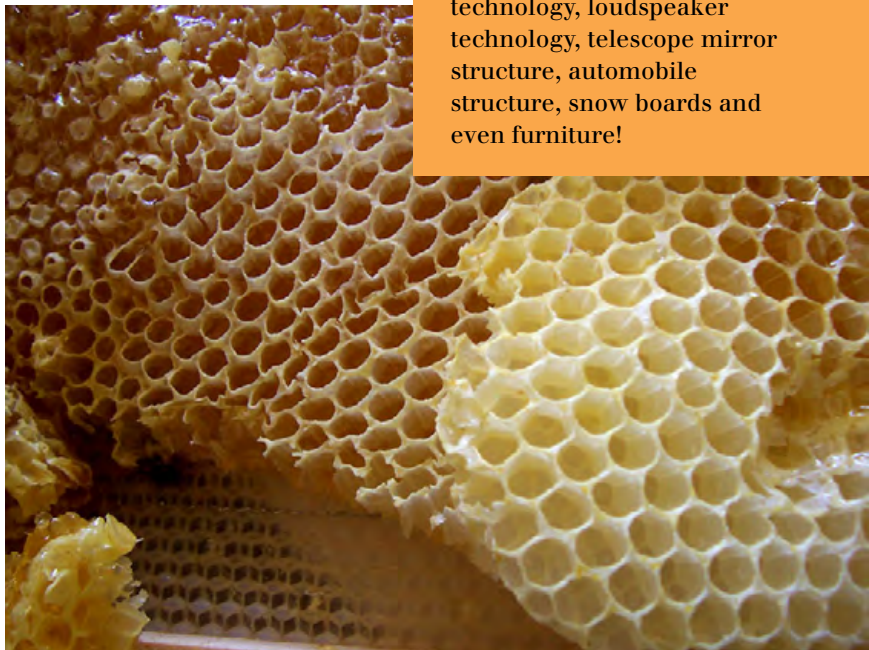
Using a honeycomb grown at a research facility in Beijing, these researchers found clear evidence that the cells first start off as circles. They are then heated, and pulled into hexagonal shapes by **surface tension**^o at junctions where three walls meet.

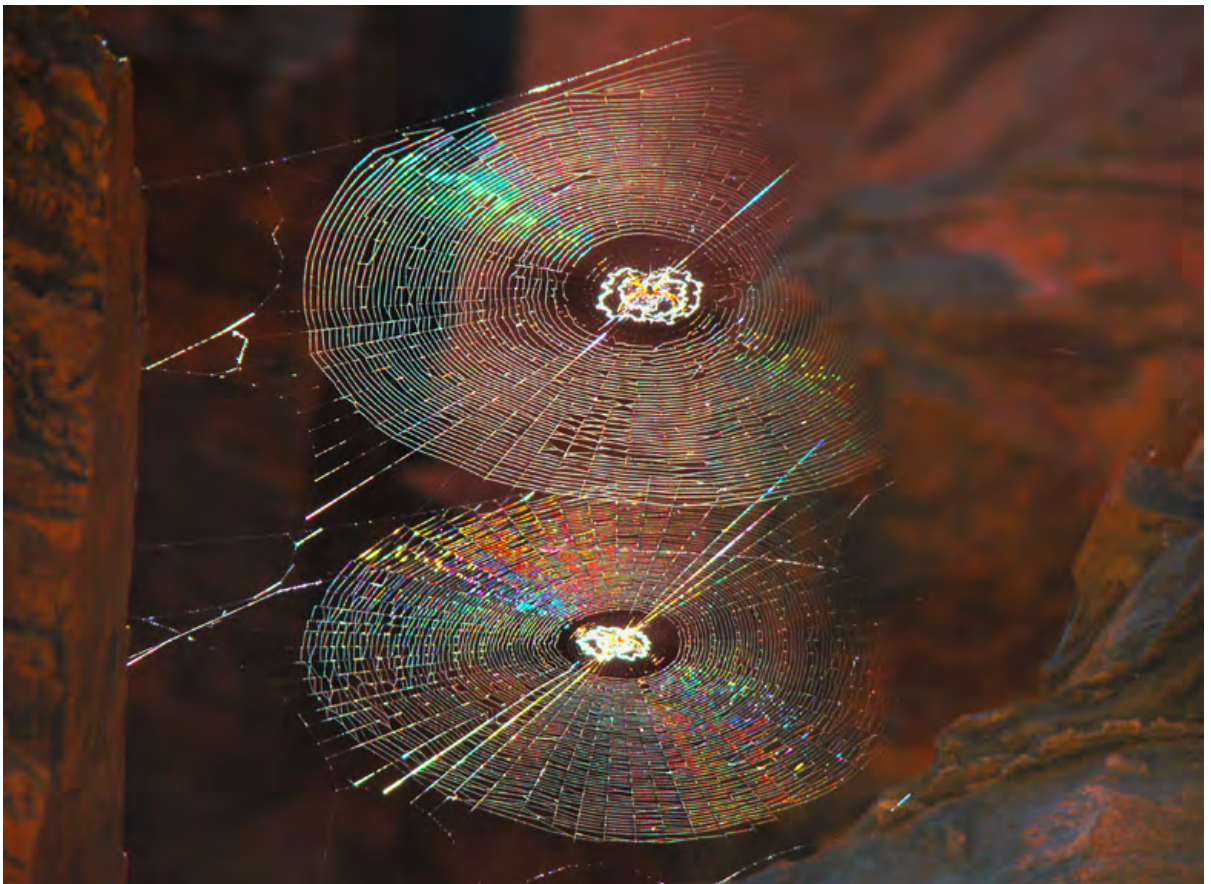
It was observed that specialist 'worker' bees heat the cells and melt the wax. Then, the cell walls naturally fall flat and take on the shape of a hexagon, like adjoining bubbles in a bath. This is physically the simplest and most stable way for cylinders to merge.

But, researchers still do not know how the bees heat each

cell. There are two plausible scenarios: A. bees focus their heat only at points where neighbouring cells touch, and B. the bees heat the entire cell at once. ■

Humans have taken great inspiration from honeycomb structure. This technique is used in racing shells, aerospace manufacturing, gliders, helicopters, jet crafts, rocket structure, LED technology, loudspeaker technology, telescope mirror structure, automobile structure, snow boards and even furniture!





Spider webs

Spider webs are so intricate that they can leave you speechless. Believe it or not, the threads a spider uses to construct its web begins as a liquid (that dries quickly in air).

A spider begins constructing its web by releasing a single thread of silk that forms the base for the structure. When the spider feels that this first thread has anchored itself to something, it cinches up the silk, attaches it to a starting point and starts building the web around it.

Check this video out to

understand this in detail:
www.watchknowlearn.org/Video.aspx?VideoID=88

The main reason spiders spin webs is 'food'. When an insect flies into a spider's web, it gets stuck on the sticky threads.

Web-spinning spiders have an innate ability to tell the difference between vibrations from prey and other sources (a leaf falling onto the web, for example). Many species can also identify vibrations of dangerous insects, such as wasps, from their preferred prey.

The silk used to build the

web is made of proteins, and is stronger and more flexible than steel of the same weight! This has the potential to be used in protective gear like bulletproof vests, and even to make **artificial tendons**⁶! ■

Did you know:

In ancient European medicine, cobwebs were used on wounds to discourage infection, promote healing and reduce bleeding.

Cobweb painting is an old art form that originated in the 16th century. Today, fewer than 100 of these exist, most of which are housed in private collections.



TAJ MAHAL TURNS YELLOW

by Bhoo

Pollution is turning the symbol of love yellow. Here's a conversation that I heard between two love birds, when flying around the Earth one evening.

Love Bird 1: Oh dear! What have humans done to Mumtaj Mahal's mausoleum?

Love Bird 2: Is it a problem with my eyesight or has Taj been painted yellow?

LB1: Not both. This Unesco World Heritage site that attracts millions of visitors each year has slowly been losing its sheen and turning yellow! Increased air

pollution's been affecting it adversely.

LB2: Oh! But, how does pollution affect structures? It's not like they are human!

LB1: The colouring is apparently due to high levels of 'suspended particulate matter', or tiny granules of dirt in the air, generally caused by dust and burning fossil fuels.

LB2: Oh, dear me! Is there not a way to prevent this?

LB1: The Indian government has began working on the issue 7-8 years ago. It has set up the Taj Trapezium Zone, a 10,400 sq. km. area around the monument where strict emissions standards are in place.

Cars and buses are allowed to drive not to the Taj Mahal, but to a parking lot about 1.5 miles away. A pollution monitoring station has been set up too.

LB2: That's good. But, what about the damage that's already done?

LB1: As a conservation measure, a clay pack treatment, which is noncorrosive and nonabrasive is being carried out. This would, hopefully, remove the pollution particles, and restore the natural sheen and colour of the white marble monument.

The last mud-pack was applied in 2008, but pollution levels around the monument remain high, and officials say it needs **cleaning** again.

LB2: Ok. Let's hope that things work out and our future generations get to see the Taj Mahal live than only in photo albums. ■

List out ways to protect structures from pollution. Research and email to Bhoo at brainwave@ack-media.com to get a chance to be nominated for our Student Board as well as to win a surprise gift.

Stepwell

.....
*A smart way to store
water in arid regions.*
.....

In the northern Indian states of Rajasthan and Gujarat, 'water' was a severe problem. These states experience seasonal monsoons, but the water quickly sinks into the sandy soil. Hence, 'holding' rain water is a top priority.

Known as baori, stepwells were constructed to collect and store rainwater in these arid climates. They mainly consist a vertical shaft from which water is drawn and the surrounding inclined subterranean passageways, chambers and steps which



**STORY
STOREYS**

by Pushkar Samant

provide access to the well.

The earliest stepwells date back to 550 A.D! More than 3,000 stepwells were built in these regions in ancient India.

Built in Rajasthan in the 9th century, Chand Baori is among the largest of India's many stepwells. It is 13

stories tall, 100 feet deep, and lined with 3,500 steps!

During the British rule, authorities were not satisfied with the hygiene in these stepwells. So, they replaced them with pipes and pumps. Although many have fallen into disrepair since then, hundreds still exist. ■

Why does the Tower of Pisa lean?



.....
*To err is human. One such mistake made in the 11th
century resulted in a leaning structural wonder!*
.....

The story of 'Tower of Pisa' began in 1173. Thanks to the soft ground and inadequate foundation it was built on, it had begun to lean by the time its builders finished the second storey in 1178.

Its engineers tried to compensate for this by building the upper floors such that one side's taller than the other, but that didn't work. Over the next 800 years, it became clear that the tower wasn't just leaning. It was

actually 'falling'. By 1990, its top was displaced horizontally by 3.9 meters!

Though the 'tilt' was necessary to attract tourists, it was important to stem the fall. So, after a decade of efforts, in 2001, the tower was declared stable for at least another 300 years.

In May 2008, engineers declared that the Tower had stopped moving for the first time in its history! Let's hope that it stays that way. ■



THE SMARTIES

MISSION RED PLANET: EPISODE 6

STORY: SASIKANTH C & PRIYANKA TALREJA

ART & LETTERING: POOJA PRABHAKARAN

PREVIOUSLY... THE FINAL 10 CANDIDATES SELECTED FOR THE 'MEN ON MARS' MISSION BEING LAUNCHED BY VISION GALACTIC HAVE ARRIVED AT THE TRAINING FACILITY. SOME HIT IT OFF WELL WHILE OTHERS AREN'T ABLE TO GROW BEYOND THEIR EGOS...



THIS PLACE CAN DO WITH A WHOLE LOT OF FIXING.



YOUR HEAD CAN DO WITH A LOT OF FIXING.

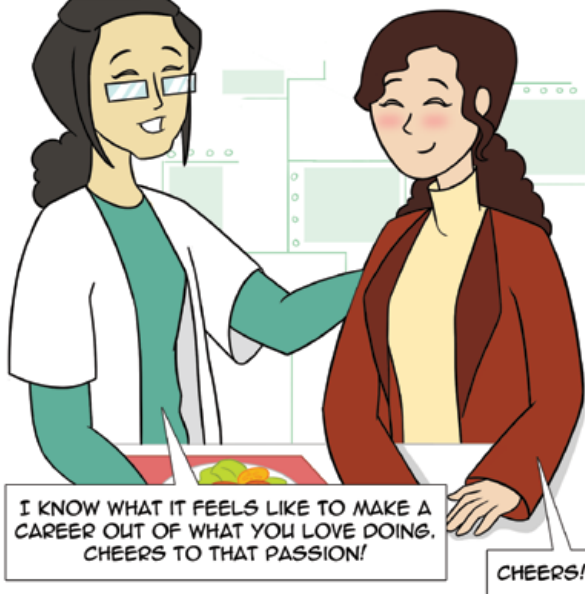
EXCUSE ME!?

WHILE ON THE NEXT TABLE...



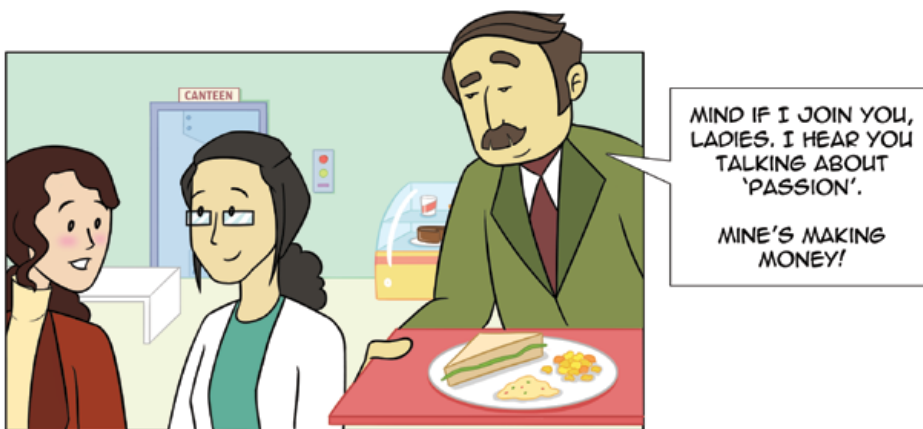
SO YOU ARE A PILOT, EH?

YES MA'AM! CAN'T TRAVEL ON AN AIRCRAFT WITHOUT EITHER FLYING OR NAVIGATING IT.



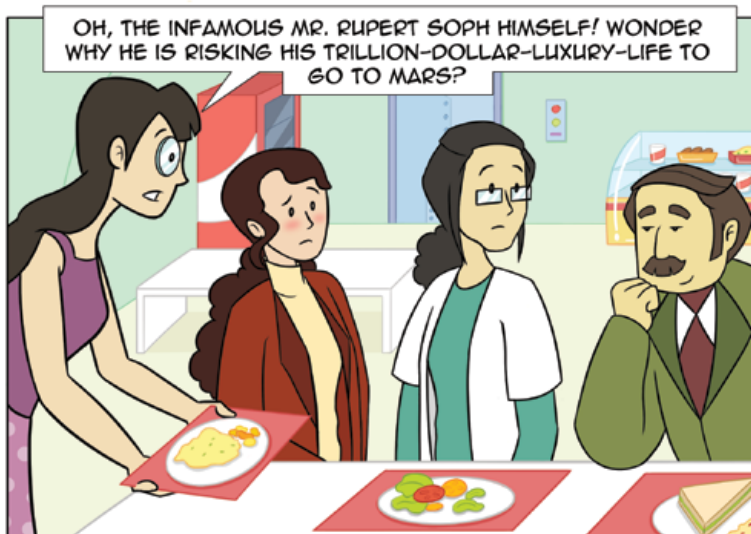
I KNOW WHAT IT FEELS LIKE TO MAKE A CAREER OUT OF WHAT YOU LOVE DOING. CHEERS TO THAT PASSION!

CHEERS!



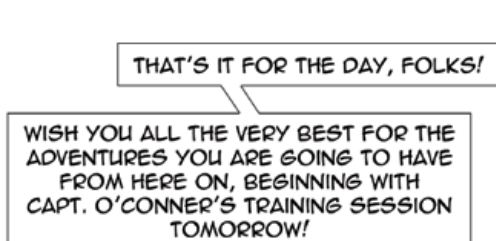
MIND IF I JOIN YOU, LADIES. I HEAR YOU TALKING ABOUT 'PASSION'.

MINE'S MAKING MONEY!



OH, THE INFAMOUS MR. RUPERT SOPH HIMSELF! WONDER WHY HE IS RISKING HIS TRILLION-DOLLAR-LUXURY-LIFE TO GO TO MARS?

WHEN MY WIFE OF 20 YEARS AND KIDS DON'T UNDERSTAND IT, HOW WOULD YOU, DARLING?



THAT'S IT FOR THE DAY, FOLKS!

WISH YOU ALL THE VERY BEST FOR THE ADVENTURES YOU ARE GOING TO HAVE FROM HERE ON, BEGINNING WITH CAPT. O'CONNER'S TRAINING SESSION TOMORROW!

GOOD NIGHT!



THE NEXT DAY...

TO BE CONTINUED..



SUSPENSION BRIDGE

by Pushkar Samant

Suspension bridges can easily be of 2,000 to 7,000 feet, enabling them to span distances beyond the scope of other bridge designs.

You will need:

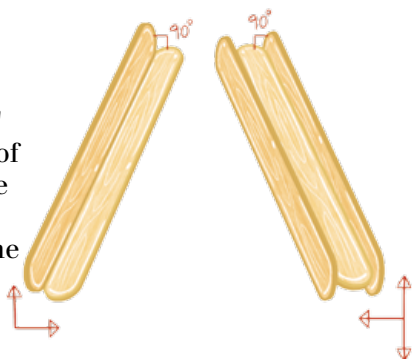
- Cardboard
- Popsicle sticks
- String
- Fevicol or wood glue
- Ruler and pencil
- Scissor or paper cutter



Method:

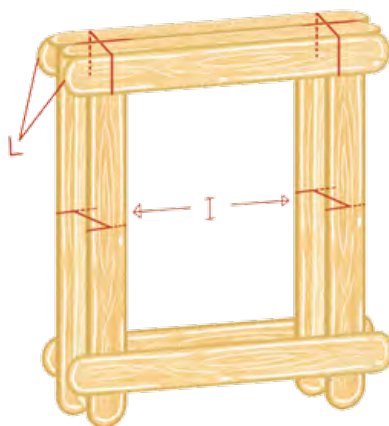
Step 1

Make four 'T' beams and four 'L' beams out of the popsicle sticks, as shown in the figure.



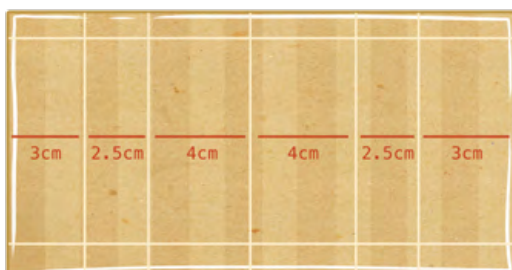
Step 2

Combine them with each other to make two pylons. Attach two more popsicle sticks to the bottom of the pylon, as shown.



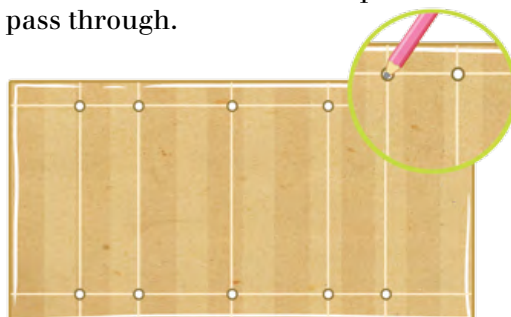
Step 3

Take a cardboard. Measure out the deck as shown in the figure.



Step 4

Punch holes (five on each side of the board), as shown. This will enable suspension cables to pass through.





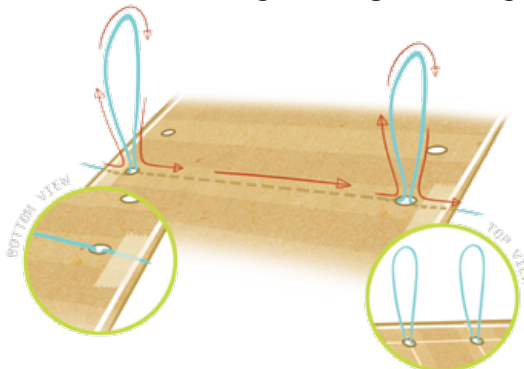
Step 5

Cut five pieces of a string, each eight to nine inches long.

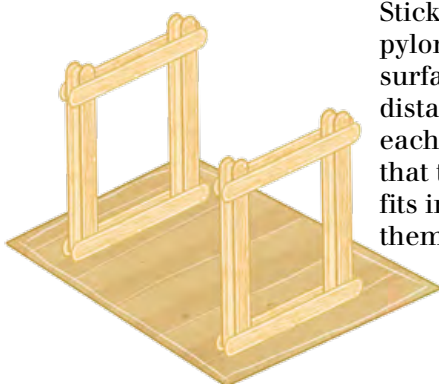


Step 6

Pass the strings through the holes of the cardboard (deck) and stick them with tape, as shown. Don't forget to loop the strings.



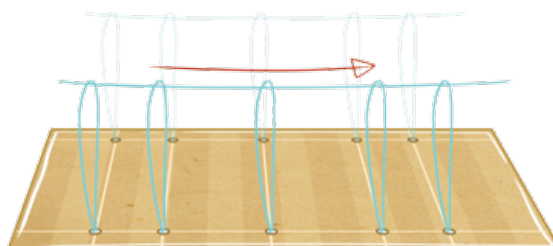
Step 7



Stick the pylons on a flat surface, at a distance from each other such that the deck fits in between them.

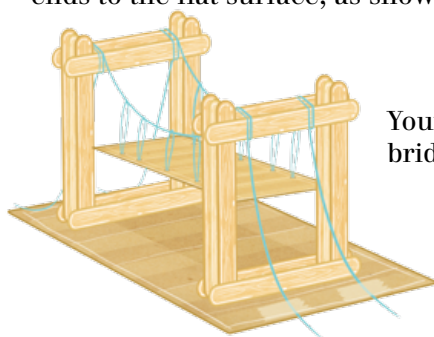
Step 8

Take two long strings and run them through the loops, as shown.



Step 9

Tie the strings to the pylons and stick their ends to the flat surface, as shown.



Your suspension bridge is ready! ■

How does it work?

The suspension bridge is pretty simple to understand. The deck is held up by suspenders (in our prototype, loops) that are attached to a cable (in our prototype, the strings through the loops). These are made of steel and have fixed state of tension. The system is held up by towers or pylons, typically made of a concrete and stone combination.

Treasure Hunt!

You must be aware of the grind by now. The Treasure Hunt leads you to the theme of the next issue. Take your magnifying glass out and become the adventurer. Follow the words or phrases marked in **violet** in this issue and use them as your clues.

oooooooooooo

Look closer and you will find enough clues to get you cracking. What are you still waiting for? Get started and finish fast, to better your chances of a win!

The top entry will win a summer special pack of cool ACKs and Tinkles. Email your answers to brainwave@ack-media.com with 'Treasure Hunt' as the subject.



Artwork: Sathnak Sinha

Be a Smartenstein!

We run more than ten activities and contests in each issue. They can win you many exciting prizes.

Participate in all the activities of an issue, and you can win a merit certificate, the title 'Smartenstein' and a mystery gift - every month!

There are more than 10 activities and contests in this issue. Turn to the index on **p02**, check the features marked with a '★' out, and participate in them.

What are you waiting for? Settle down with your favourite snack and get started!

www.bwmag.in/category/bw-smartenstein



Crazy Construct

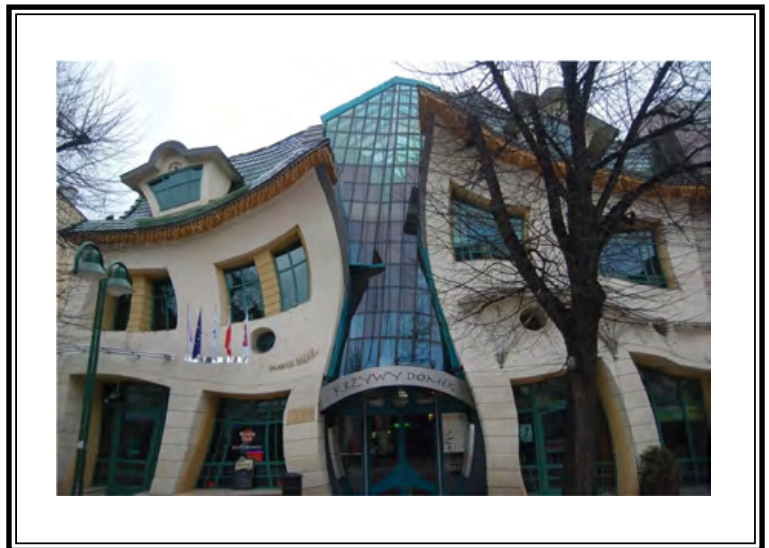
by Skree!

Brilliant work of architecture can be witnessed in some structures!



Krzywy Domek – It might look like a typo, but it is not. Like the structure itself, Krzywy Domek in Polish means 'little crooked house'. It is an irregularly shaped building in Sopot, Poland. It is approximately 4,000 square meters in size.

Szotyńscy & Zaleski, who were inspired by the fairy tale illustrations of Jan Marcin Szancer, designed the Krzywy Domek. Colourful stained glass entrances, stone elevation decors and windows framed with sandstone give a special impression. ■



Can you guess what the image at the top of this page is?

Email to brainwave@ack-media.com in detail to get a chance to win cool gifts worth Rs. 150!



ANTS VS BULLIES

(Fiction)

Written by : Sasikanth C.

Art by : Parvati Pillai

It was 10,000 B.C; an important meeting was in progress,
It was news - the crazy ant Zocah has convened a congress!

Fellow colony ants,
Listen to me!

It's high time that we act,
and save our herd.

130 Mn years ago we evolved;
alongside the dinosaurs we lived.

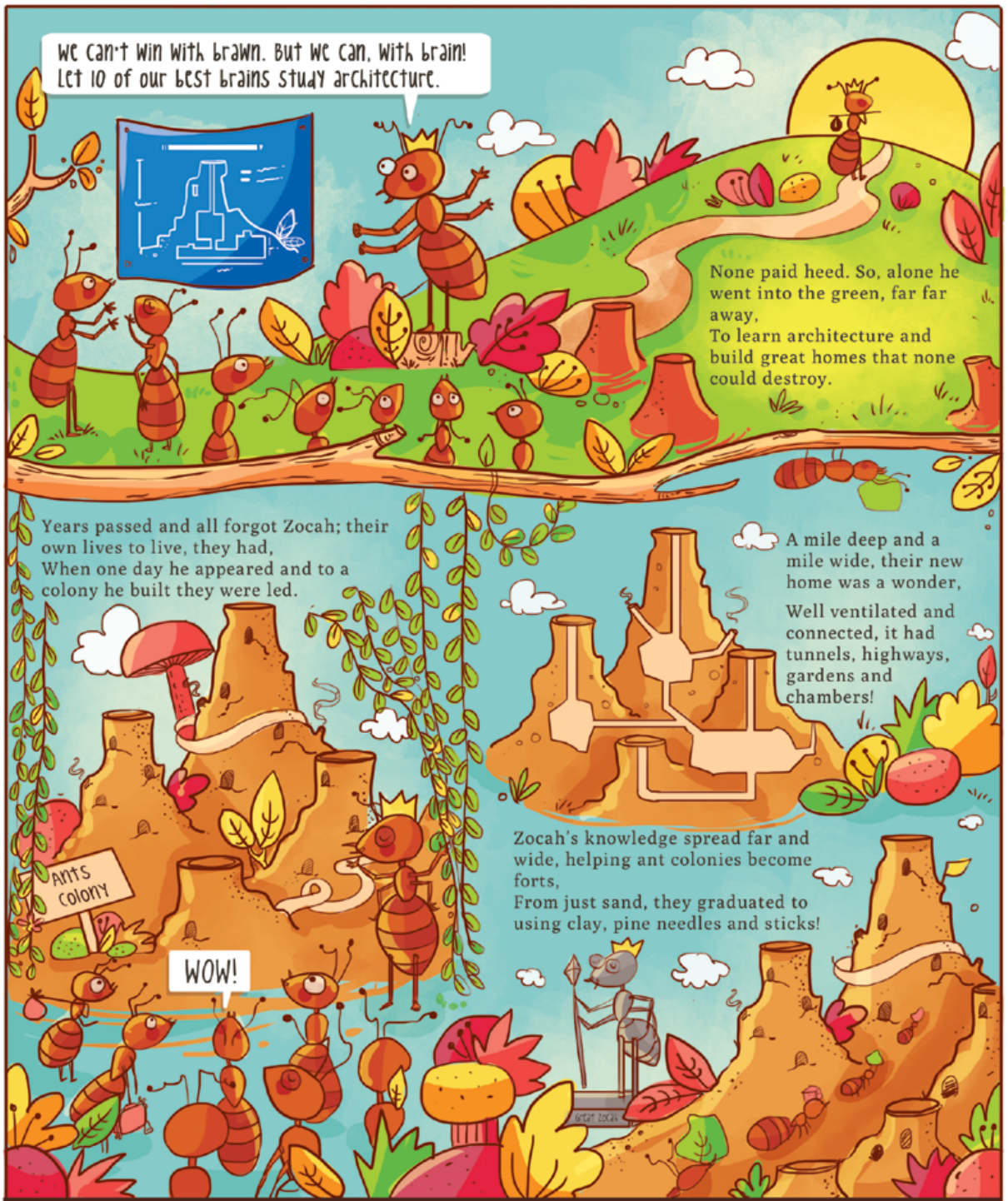
50Mn years before humans,
we grew crops and enhanced the yield.

The biomass of all ants on Earth is
more than that of humans; we are rife!
We move 50 tons of soil per year in a
square mile, aerating it and helping life.

Yet, the occasional human bully destroys our home, wreaking havoc.
This has to stop; all we ever do is run away in panic!

Hearing that, at Zocah, every ant laughed.

Humans are mighty. What can we do?



Don't believe it possible? Watch www.wimp.com/antcolony/
Know that, 6000 k.m. wide, discovered in Europe, is an ant super-colony!

The end. 



Funny Forms

by Priyanka Talreja

Sanity is routine (and boring). Let's step out and look at some 'slightly' mad stuff.



Image Source: Wikimedia commons

We have already read about the Crooked House of Sopot, Poland - stuff inspired by fairy tales. Let's take a look at two more of the wackiest buildings ever constructed.

VICTORIAN WATER TOWER NEW ROMNEY, KENT

Believe it or not, this weird structure was originally a water tower. It was built by in 1902 in the hope that it would help the surrounding buildings, and a nearby golf course. But, destiny had other plans for this one. Due to the sea water contamination, it could never be used for what it was built.

Now, though it looks like some kind of folly, it is actually a fully functioning building and is a private residential property. ■

MARINA BAY SANDS, SINGAPORE

If you want to blow away money, then which place would be better than the most expensive casino in the world?

This one's super grand. This is Marina Bay Sands, an integrated resort in Singapore. This is located on 15.5 hectares of land, with gross floor area of 581,000 square meters. At US\$ 5.7 billion, it's said to be the world's most expensive building, including the cost of prime land! Yes, you read that right. ■





p18

Hydraulic: In fluid power, hydraulics is used for the generation, control, and transmission of power by the use of pressurized liquids. Hydraulic machines are machinery and tools that use liquid fluid power to do simple work.

p27

Ramparts are defensive walls.

p28

Metallurgy: Metallurgy is the technology of metals - the way in which science is applied to the production of metals, and the engineering of metal components for use in products for consumers and manufacturers. The production of metals involves the processing of ores to extract the metal they contain, and the mixture of metals, sometimes with other elements, to produce alloys.

p29

Seismic Activity: Seismic waves are waves of energy that travel through the Earth's layers, and are a result of an earthquake, explosion, or a volcano that imparts low-frequency acoustic energy.

p32

Supernova Stellar Explosion: A supernova is a stellar explosion that briefly outshines an entire galaxy, radiating as much energy as the Sun is expected to emit over its entire life span, before fading from view over several weeks or months. Watch: www.youtube.com/watch?v=YGSUBEMWteA

p34

Surface Tension: The molecules at the surface of a liquid attract each other and form a surface 'film', which makes it more difficult to move an object through that surface than to move it when it is completely submersed.

p35

Artificial Tendons: A tendon is a tough band of

fibrous connective tissue that usually connects muscle to bone and is capable of withstanding tension.

p40

Pylons: The use of the pylon, a simple tower structure helps build railroad bridges, mass-transit systems and harbors. Their use is most prevalent in suspension bridges and cable-stayed bridges.

★ Sci-Q Time

Finished reading the magazine?
Answer these questions to win a
mystery gift worth Rs. 150! Email
to brainwave@ack-media.com

1. What are the key factors to consider before and while building structures?
2. How are suspension bridges better than normal ones?
3. How does the hexagonal shape of the cells of a honey comb help hold more honey?
4. What are the benefits of an inclined plane?

o o o o o

To take part in some cool science initiatives, visit www.bwmag.in

Here's something unique we are building for you:

www.brainwave-edu.com

Readers, get to see behind the scenes:

www.facebook.com/brainwavemag

www.brainwave-edu.blogspot.com

SUBSCRIBE NOW!

Pay only ₹ ~~720~~ 580!
Get 12 issues of

20%
OFF



Why pay ₹ 60 every month (that's ₹720 a year)
at your news-stand to enjoy Brainwave?

Now, Brainwave is the perfect balance of science and fun, which will make you call your friends up and say, "Guys, let's play science!"

You get 48+ pages of comics, stories, experiments and cool contests. There's a Treasure Hunt too! You can win many exciting prizes, and even be on our **Student Board**.

SUBSCRIPTION TYPE

- ☐ 1 year: Brainwave - ₹580
- ☐ 2 year: Brainwave+mystery gift of ₹249 - ₹1150
- ☐ 1 year: Brainwave+Tinkle Magazine - ₹880
- ☐ 1 year: Brainwave+Tinkle Digest - ₹1100
- ☐ 1 year: Brainwave+Tinkle Mag & Digest - ₹1380

YOUR DETAILS*

Student's Name: _____
Guardian's Name: _____
Date of Birth: _____ (DD MM YYYY)
Address: _____

City: _____
State: _____
School: _____
Class: _____
Email (Student): _____
Email (Guardian): _____
Tel. of Guardian: (R): _____
Mobile: _____

Guardian's signature

PAYMENT OPTIONS

☐ CREDIT CARD

Card Type: ☐ Visa ☐ MasterCard
Please Charge ₹_____ to my Credit card
Number below:

□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □

Expiry Date: / /

Card member's signature

☐ CHEQUE/DD

Enclosed please find cheque/DD no. □ □ □ □ □ □
drawn in favour of 'ACK Media Direct Ltd.'
on (bank) _____,
for the amount _____,
dated / / .

ONLINE SUBSCRIPTION

Visit: www.amarchitrakatha.com
Email: brainwave@ack-media.com

Amar Chitra Katha, Sumer Plaza, 2nd Floor,
Marol Maroshi Road, Marol, Andheri (East),
Mumbai - 400059.

Publisher, at its sole discretion, shall have the right to revise the offer or subscription price.

* All fields are mandatory for the subscription to be activated.



**BORN TO BE
ME**

*Follow the voice inside,
the voice that makes you one of a kind.*

CELEBRATING YOUR UNIQUENESS.



Scan with your smartphone &
join us on facebook/classmate

Email us at classmate@itc.in or call 1800 425 3242

classmate
BECAUSE YOU ARE ONE OF A KIND

PARLE

Melody Cool Tattoo Offer!

A stylish range of crazy-cool tattoos is here! Get one tattoo free with two Parle Melody toffees. Wear them, like you wear your attitude and bling it on. Collect them all - the more you get, the better your style!

Melody Khao AUR KHUD KA STYLE DIKHAAD

FREE TATTOO
STICKER/STAMP/STATIONERY

PARLE Melody chocolate

Offer valid till stocks last. Stocks also available without this offer.

everest/PB/276-13

WHAT IS BRAINWAVE?

Brainwave is a children's science magazine from the house of Amar Chitra Katha and Tinkle.

We understand that each child has a different aptitude and love for science. Hence, we simplify science into forms that excite them - comics, stories, fun-do activities, contests and fascinating facts.

Give your child a Brainwave... and science will be just another game!



House of Cards

by Sasikanth C

Let's build a house of cards, and see how firm and for how long it would stand...

Remember that when you were young, you and your siblings spent hours building a house from a deck of cards? Why not try it out again, with a little science on your side? It's simple, fun and also teaches the concept of 'foundation'.

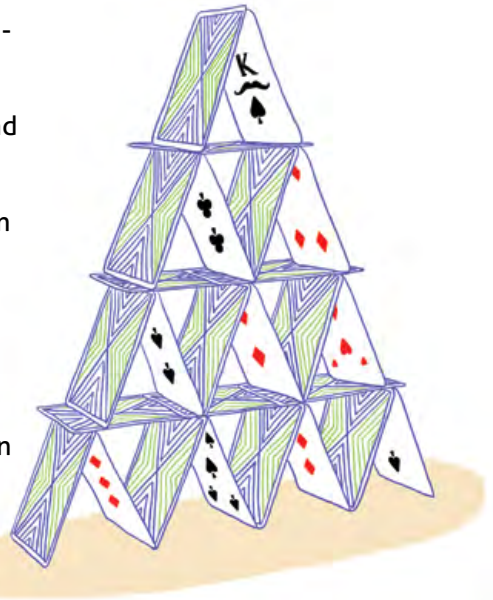
Find a flat surface to be the platform to build your playing-cards-house on.

Challenge your friend or sibling to build one that could be stronger and stand longer than

yours. However, play a trick -

Let your friend build it on a smooth surface. But, you find a rougher surface, such as cardboard or carpet. Carpet is actually great. The friction holds your first layers of cards really well i.e. gives you a strong foundation to build the house on.

This concept of 'foundation' is used in every construction built anywhere. No building can stand firm without a good foundation. ■



Here's how Brian Berg built the largest card stacking structure ever - www.youtube.com/watch?v=ivgKaQanz5k

Try this, and email the details of your record with a couple of pictures to brainwave@ack-media.com to get a chance to win cool gifts worth Rs. 150!



Like us on
Facebook

www.facebook.com/brainwavemag

VISIT OUR WEBSITE
FOR MORE PRODUCTS
www.bwmag.in/subscribe



STRUCTURES AND OUR WORLD

by Arby

The world is full of some amazing structures,
Some are functional while others are just
wonders.

Tall buildings are what we know as
skyscrapers,
The sign of a city's economic supremacy,
these tell us about its coffers.

Let's talk next about nature's magical caves,
These seem simple, but to be formed take
hundreds of years.

A combination of chemical processes and
water erosion,
tectonic forces and atmospheric influence...
aren't these a truly wonderful creation.

Now, let's talk about the igloo,
It's an ice shell structure that serves as a
strong home for a few.

What's a shell structure, did you ask?
It's a shape that support loads, even without
solid mass!

It's a thin, outer layer of material that's
carefully shaped,
To spread force throughout the construction,



giving strength so the ceiling can hold!

Time to take a closer look at a great wonder,
The pyramid of course is a huge mass
structure!

Mass structures aren't solid. They are
layered, in fact!
They have hollowed out areas for specific
functions, you ought to know that.

These must be heavy enough, but without
impacting the earth below unevenly, to stay
in place,

And yes, they must be anchored firmly to stay
beautiful for generations to gaze.

Now that you know a great deal about
structures,
Observe buildings and send in your letters! ■